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# Are REC Markets a **WRECK** Waiting to Happen?

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# Overview

- What do we want RPS to accomplish?
- How does a “normal” market work?
- The flaws of the current RPS Market Design
- Implications for market power
- Implications for project financing
- Possible Solutions
- Next Steps?

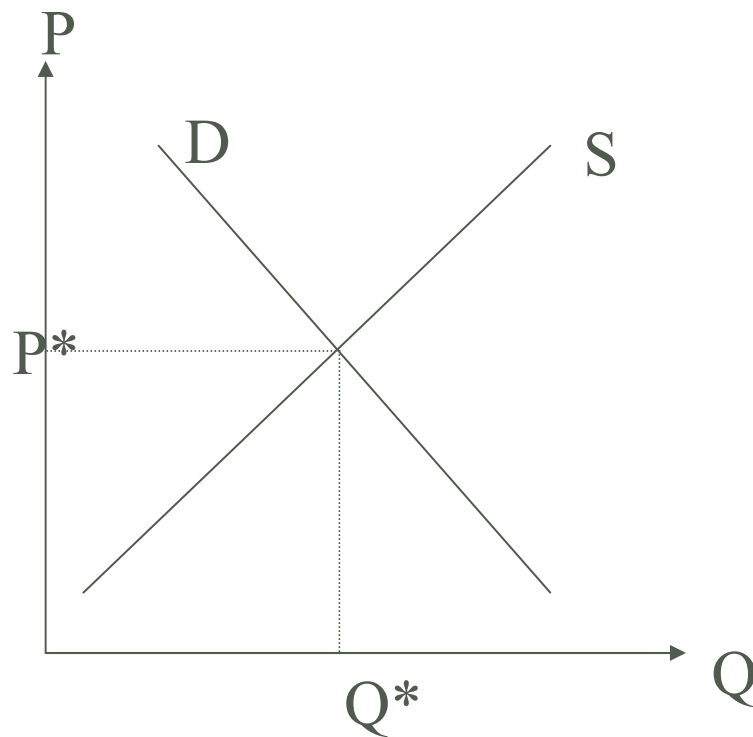


# Why a Renewable Portfolio Standard?

- **Belief that (competitive) power markets don't result in "enough" renewable power generation capacity**
  - Renewable Power provides positive externalities, i.e. benefits that cannot be captured by holders of property rights
    - Fuel Diversity Benefits
    - Energy Security Benefits
    - Environmental Benefits
    - System Risk Benefits
    - System Infrastructure Benefits
- **Idea behind RPS: Provide a revenue stream reflecting those benefits so that the socially desirable amount of renewable capacity gets built**
- **Idea behind REC markets: Efficient markets result in most efficient renewable power capacity mix (better than some form of direct regulation)**
- **Result: RPS sets the renewable capacity goal and provides a market rules framework – the markets decide on what gets built.**



# How does a “normal” market work?

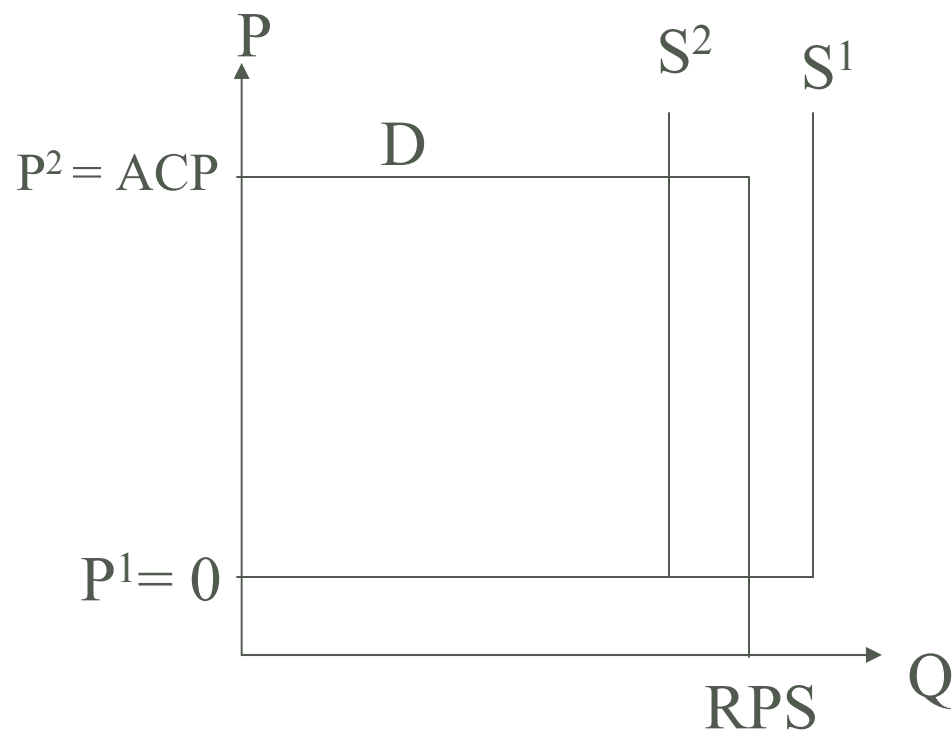


## ■ Normal Markets:

- many buyers and sellers
- increasing MC  $\Rightarrow$  upward-sloping supply
- decreasing MU  $\Rightarrow$  downward-sloping demand
- Equilibrium  $P^*/Q^*$



# How does a REC market “work”?



## ■ REC Markets:

- Vertical Demand = RPS Target
- Supply of RECs complex (joint product, MC +/- = 0 up to capacity, then infinite)
- If  $S > RPS$ ,  $P = 0$
- If  $S < RPS$ ,  $P = ACP$

# As designed, REC Markets deviate significantly from the Ideal

- **Perfectly inelastic demand**
- **Very elastic supply up to capacity**
  - Most renewable projects have high capital and low operating cost
  - REC production typically a byproduct of electricity generation
  - The MC of RECs will often be close to Zero
- **Market prices will tend to be either very low or very high, but rarely in the middle. (“Boom Bust” Cycles)**

## This can lead to

- **Market Power Problems**
- **Difficulties of financing new Projects**

## Some very preliminary observations about existing REC Markets

- **MA:** The market price of RECs is equal to the ACP and has been for a while
- **CT:** The market price of RECs used to be equal to the ACP until a single large landfill gas facility was qualified under the CT RPS. After that, the market price dropped very substantially and is now below \$10/REC
- **Forward market activity in the Northeast is very spotty and not many long-term transactions take place**



# Inelastic Demand spells market power problems

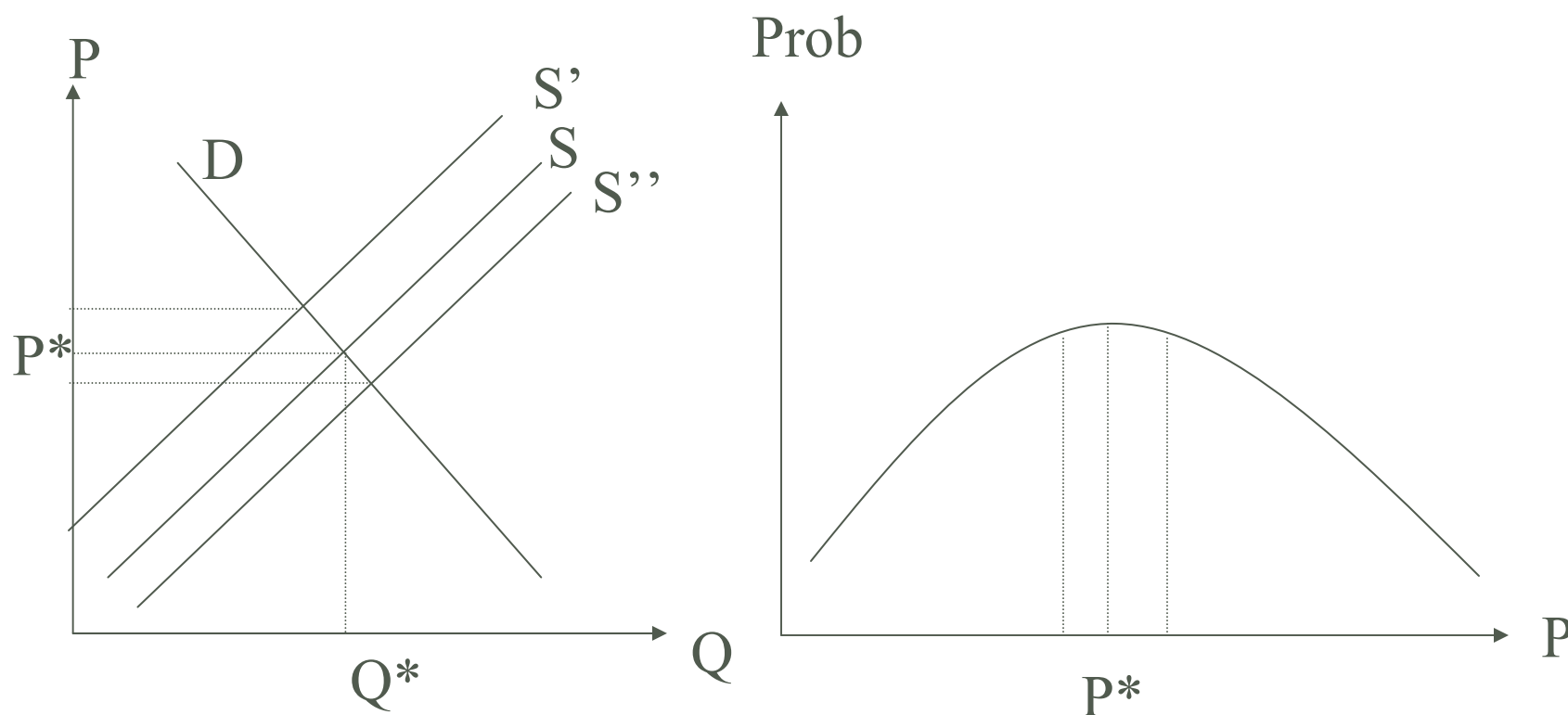
## ■ Cournot Competition Example:

- Demand = 10 ( $P^{\max} = 10 = ACP$ )
- 2 suppliers, each with Capacity = 8 and  $MC=0$
- Each firm does  $\max \pi = p \times q - mc \times q = p \times q$
- $p = 10$  if  $q_1 + q_2 < 10$ , 0 otherwise
- symmetric case:  $q = q_1 = q_2$
- $q^* = q_1^* = q_2^* = 5$ ,  $\pi_1 = \pi_2 = 50$
- Big incentive to withhold supply from the market
- Not inefficient given RPS goal, but inefficient for society (we could have generated more renewable power at no extra cost) all surplus goes to producers
- General case (no  $P^{\max}$ ): no matter how many Cournot players,  $P = \inf$ .
- **One possible manifestation: new capacity is NOT BUILT so that REC prices stay high!**

# Inelastic demand also spells a bad kind of uncertainty

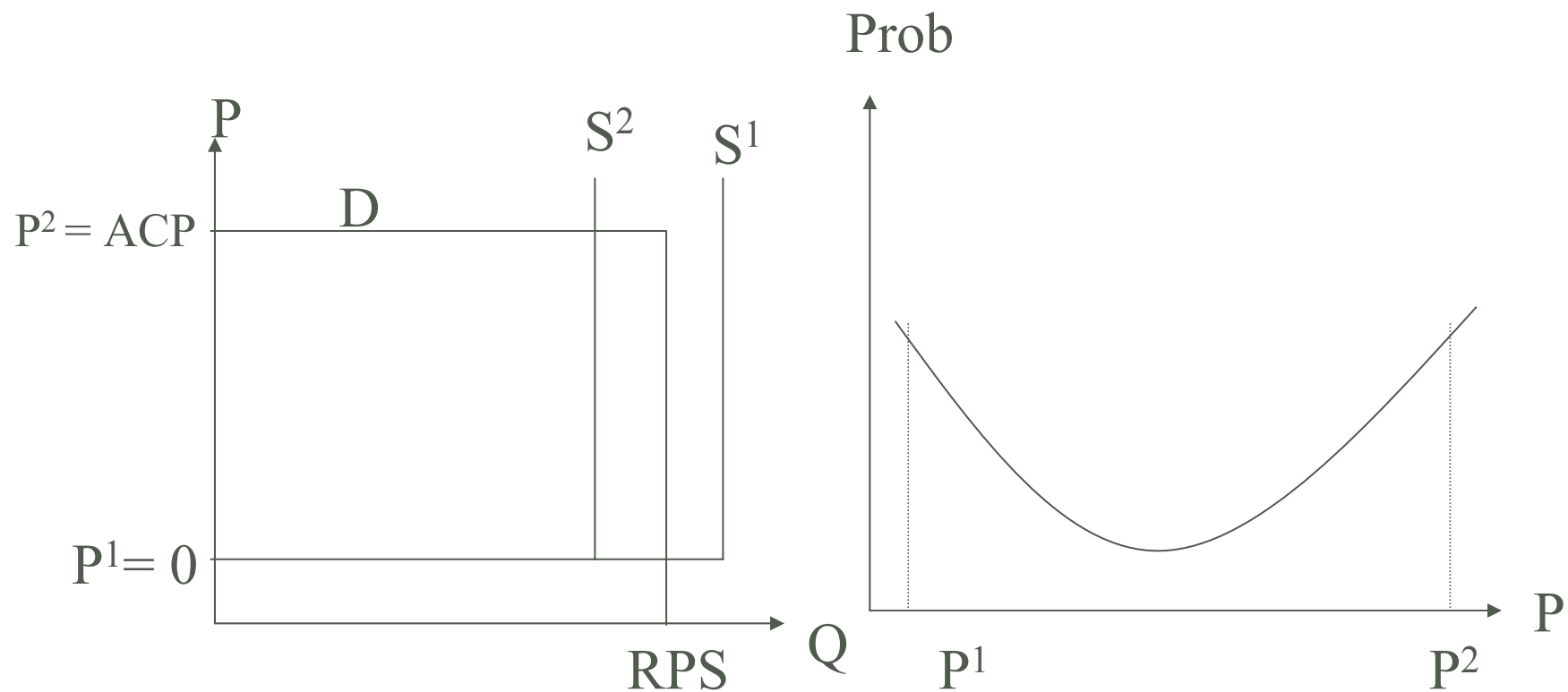
- Renewable projects get financed with a combination of debt and equity
- Typically debt is cheaper than equity
  - less risky to loan money than to invest
  - secured versus unsecured
- Debt also has tax advantages
- WACC is lower, the more leverage
  - $WACC = (1 - \text{Tax Rate}) \times \text{Cost of debt} \times \text{Debt}/(\text{Equity} + \text{Debt}) + \text{Cost of Equity} \times \text{Equity}/(\text{Equity} + \text{Debt})$
- The lower the WACC, the more projects get developed.
- This is generally true, even though the PTC currently provides an added incentive for equity financing

In “normal” markets, with uncertainty, prices fluctuate around a mean





In REC markets, with uncertainty, prices have a bimodal distribution





# Debt Financing harder with bimodal revenue distribution

- **A simple way to think about it: Coverage Ratios**
  - Level of debt financing depends on the minimum **certain** revenue stream (in our example = 0)
  - Certain revenues have to be enough to cover interest payments x times.
- **Bimodal distribution makes it hard to get any debt financing**
- **Resulting WACCs for renewable projects high**
- **Greater difficulty of financing new projects.**



# Possible Solutions

- **Inelastic Demand leads to “bad uncertainty”, which in turn leads to thin forward markets.**
- **Can be overcome by facilitating forward markets or by addressing the inelastic demand problem or both.**
- **Possible Solutions include:**
  - NYSERDA style auction mechanism, which directly creates a long-term market for renewable energy
  - MTC style instruments to reduce the uncertainty of forward REC prices resulting from the current market design
  - NYISO Installed Capacity style demand curve for RECs rather than the fixed percentage target
  - very generous banking (and borrowing) of RECs



# Pros and Cons everywhere

## ■ Long-term Auctions

- (+) creates the long-term forward market directly and hence almost guarantees development of desired level of new projects
- (-) more stranded costs as a result of long-term contracts?

## ■ MTC-style financial risk management tools

- (+) overcome the problems of the current market design
- (-) expensive to finance because of the nature of volatility

## ■ REC-demand curve

- (+) the best theoretical solution, would allow forward markets to develop “naturally” in addition to spot markets
- (-) difficult to implement politically and legally; fighting over the shape of the demand curve almost certain

## ■ Banking/Borrowing

- (+) increases uncertainty about over-/undersupply of RECs in any period and hence may facilitate forward transacting and prices between the low end and the ACP
- (-) introducing more uncertainty into a market to remedy a problem linked to uncertainty not very elegant

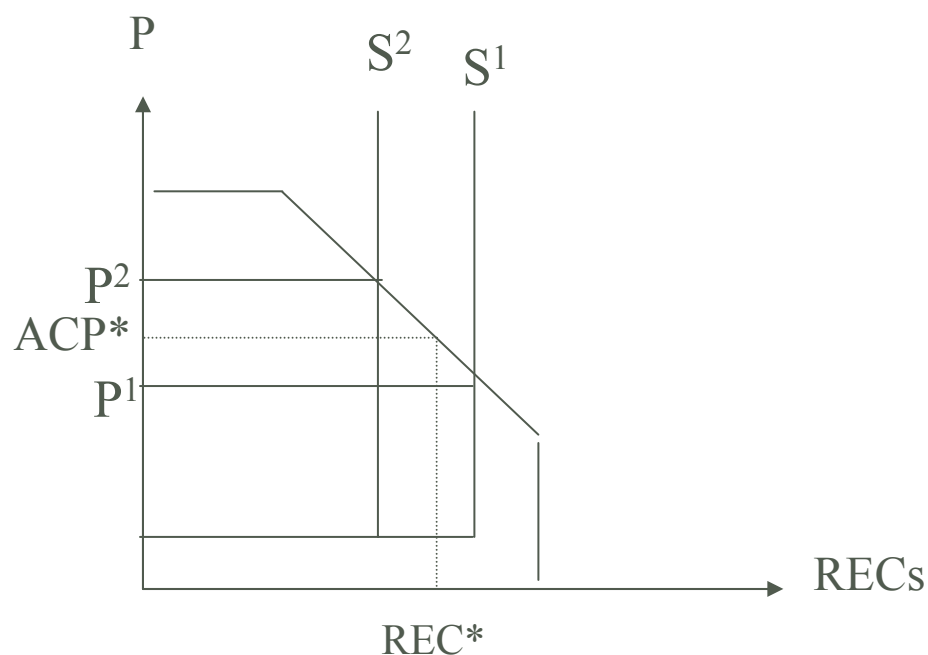


# The REC problem is not new

- **Boom Bust Cycles are a known problem in many capital intensive industries where investments are “lumpy”**
  - Shipbuilding
  - Commercial Real Estate
  - Electricity Markets
- **Specifically in Installed Capacity Markets**
- **Essentially similar solution approaches**
  - Long-term Contracts
  - Demand Curve (NYISO, NE-ISO considered)
- **NYISO Demand Curve for Installed Capacity**
- **Approved by FERC in 2006 for PJM Capacity**



# A Demand Curve for RECs?



- Would specify a target range of Renewable Capacity
- “Alternative Compliance Payments” would decrease as the renewable capacity installed increases, up to a limit
- If the range is chosen reasonably well, should get more price stability



## Next Steps to improve RPS

- **Eliminate miscellaneous obstacles to the development of a larger regional REC market due to different RPS mechanisms**
  - In-state location requirements
  - Delivery Requirements
- **Address structural problems**
  - Most likely Short Run Solution: Provide Patches to address the underlying structural problems
    - Uniform banking for several periods
    - Provide supplemental hedging tools
  - Longer Term: Address structural problem directly
    - Directly create long-term markets (by having long-term auctions in NYSERDA style) alongside current spot market
    - Consider moving towards demand curve for RECs



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